

International Oil and Ice Workshop

Anchorage, Alaska

October 10 -11, 2007

Sponsored by: ACS, Alaska DEC, Cook Inlet Spill Response Inc., Oil Spill Recovery Institute, USCG, U.S. MMS

Organized by: S.L. Ross Environmental Research and DF Dickens and Associates



FESCO Sakhalin

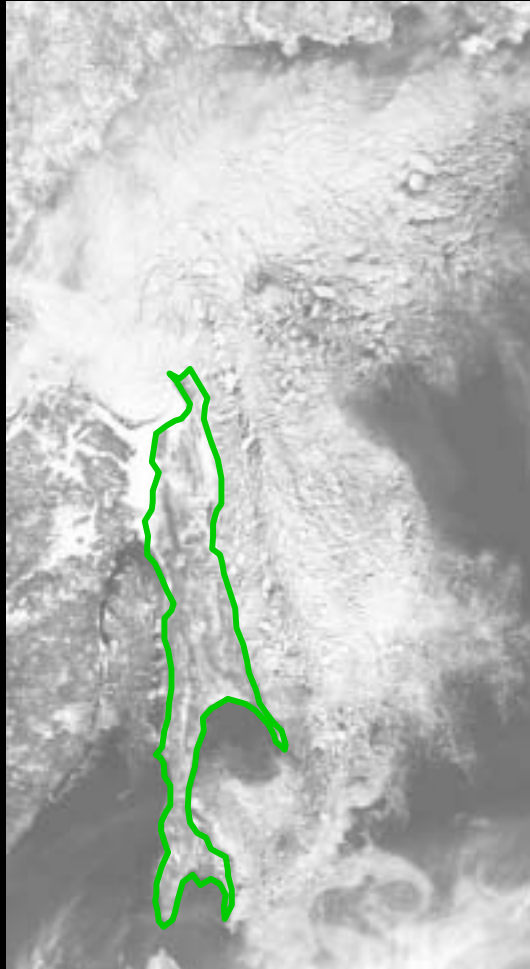


Orlan Platform



Dekastrie SPM

Sakhalin Ice Conditions



AVHRR satellite image
April 7, 1999
Island length = 950 km



Sakhalin Tanker Trials



Sakhalin Ice Floe

Why focus on “remotely applied” response options?

Four broad options for oil-spill response
in both ice and open water

- Observation only
 - Mechanical recovery
 - In situ burning
 - Dispersants
- } remotely applied options



LORI skimmer

Gulf of Finland
spill cleanup
with LORI
skimmer



Rope mop
skimmer



*Mechanical response
is challenged by ice*

Background – Initial Research Focus

Dispersants

- Show that dispersants can work in ice
 - Ice motion enhanced dispersion
- Limitations: oil viscosity / mixing energy

In situ burning

- Ice can provide containment
 - Can burn in all ice conditions
 - Can burn emulsions
- Limitations: slick thickness / weathering



Chemical dispersion of oil in ice at OHMSETT—ice motion enhanced dispersion



1983 Test burn effective in concentrated ice



2002 Tests studied limits to ISB in ice

New Dispersant Gel



SL Ross Wave Tank



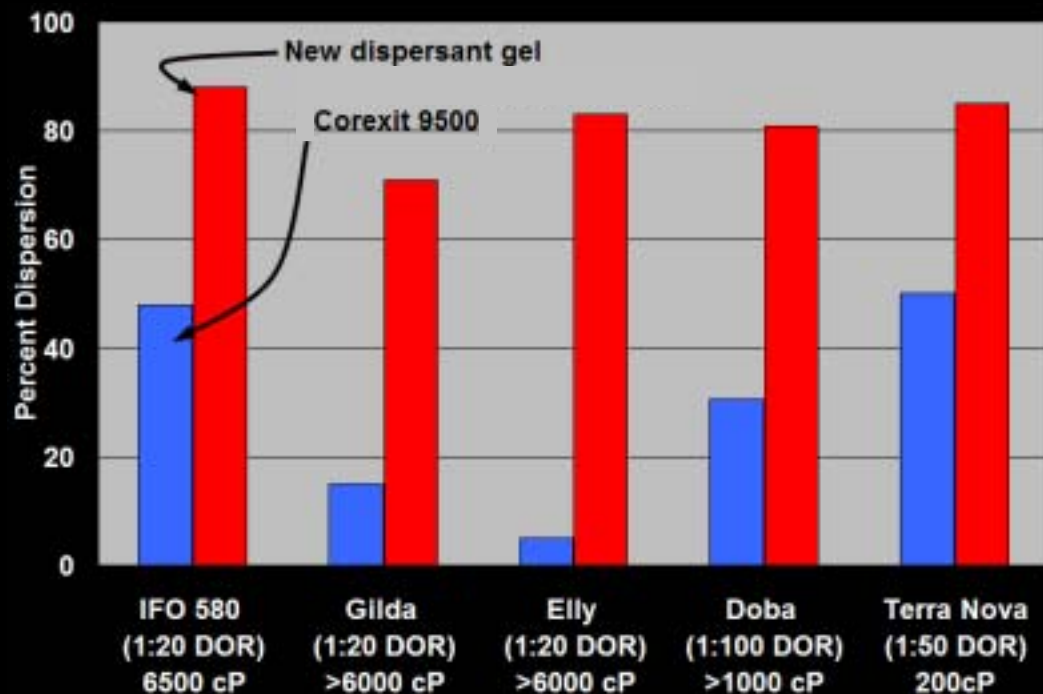
New formula

OHMSETT Wave Tank

9500 immediately
after application

Gel clearly
visible on
slick

Commercial
dispersant not
visible



Advantages

- May triple delivery capacity
- Allows dispersion of viscous oil
- Reduces spray drift
- Visible after application
- Buoyant, cohesive drops

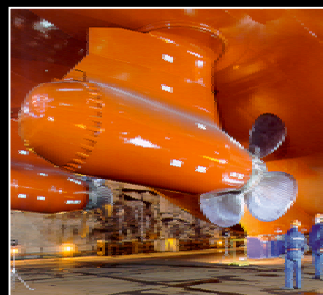
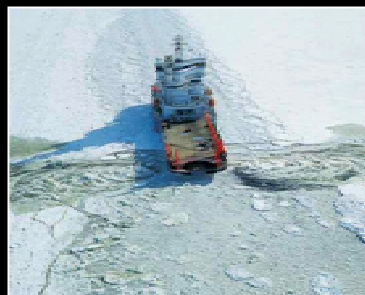
New Dispersant Gel

New Formula Dispersed the Prestige Oil



Icebreaker Enhanced Dispersion

Chemical Dispersion Enhanced by Icebreaker Prop Wash

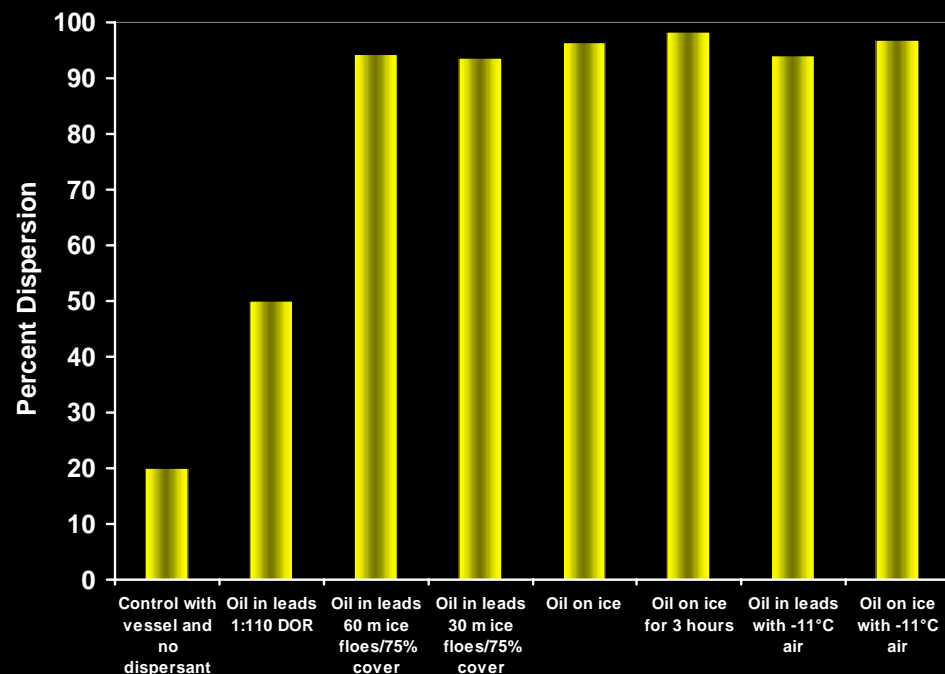


Azimuthal Stern Drive Icebreaker

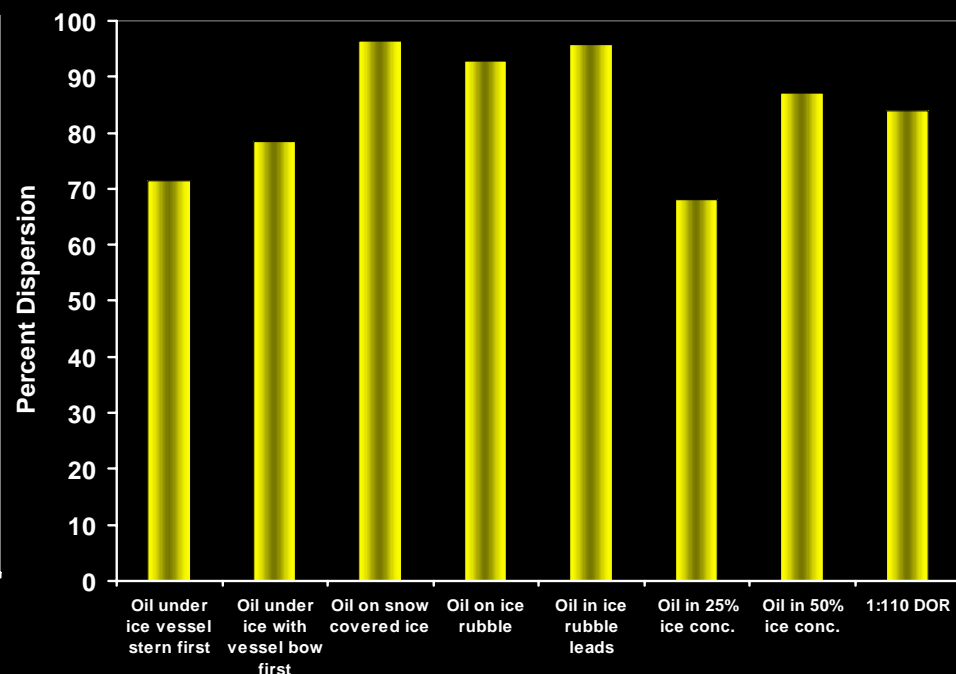


Completed positive basin tests

URC-Funded Model Basin Test Results

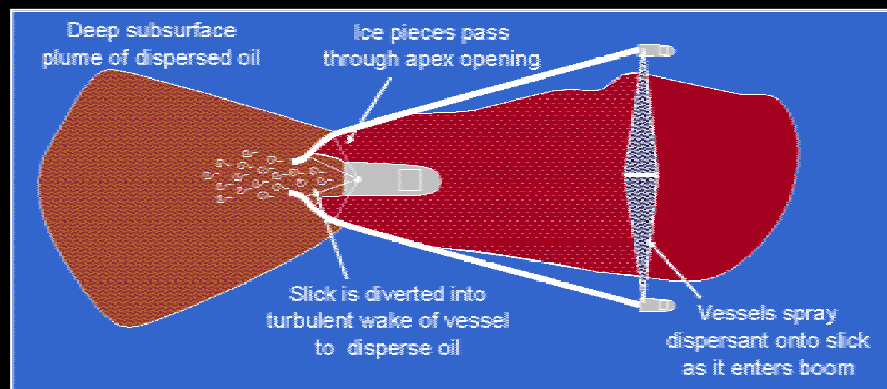


BP-Funded Model Basin Test Results

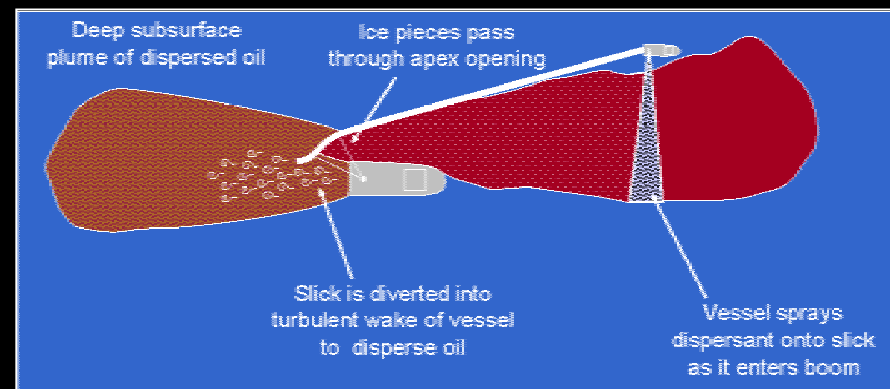


Diversion Boom Concept

Extending the Prop-wash Concept to Vessels of Opportunity and Lower Ice / Open Water



Three Vessels of Opportunity and Two Booms



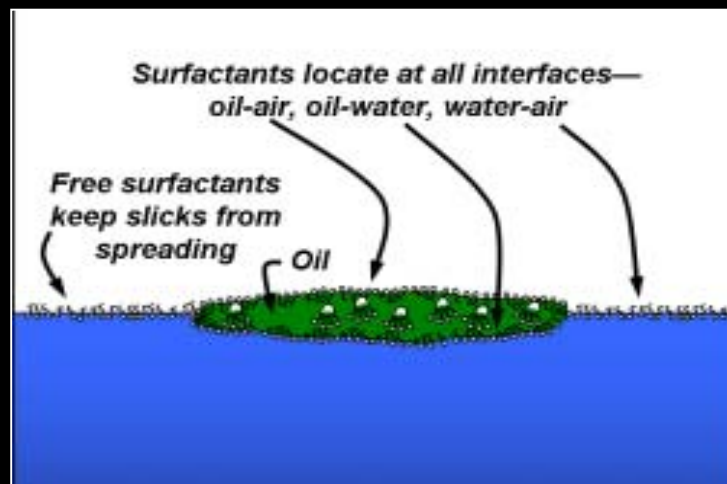
Two Vessels of Opportunity and One Boom



Completed basin tests using 1:25 scale workboat

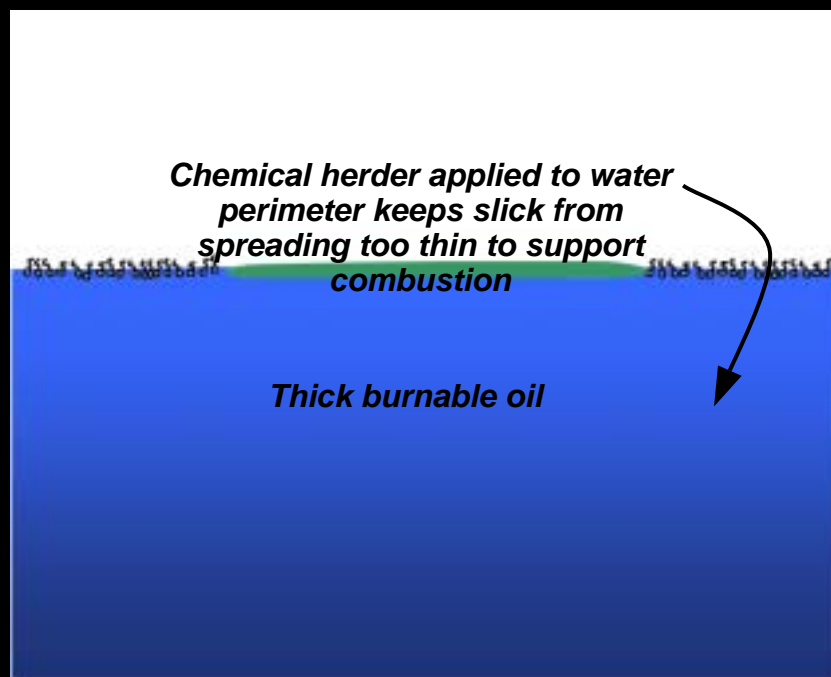
Restricted Spreading Biases Dispersant Effectiveness Tests

- Closed systems keep slicks from spreading
 - Beaker and basin walls
 - Oil containment systems
- Surfactants on water surface keep slicks from spreading
- Surfactants cover all surfaces after dispersant application
 - Overspray onto adjacent water
 - Migration from oil
- Restricted spreading increases the amount of energy required for dispersion
 - Not an issue for conventional oils with adequate mixing
 - Negatively biases dispersants effectiveness with
 - + Low energy conditions
 - + Viscous oils



In situ Burning Enhanced using Chemical Herders

- Led joint-industry project evaluating herders



Chemical herders may extend in situ burning to lower ice concentrations

Enhance in situ burning using
chemical herders

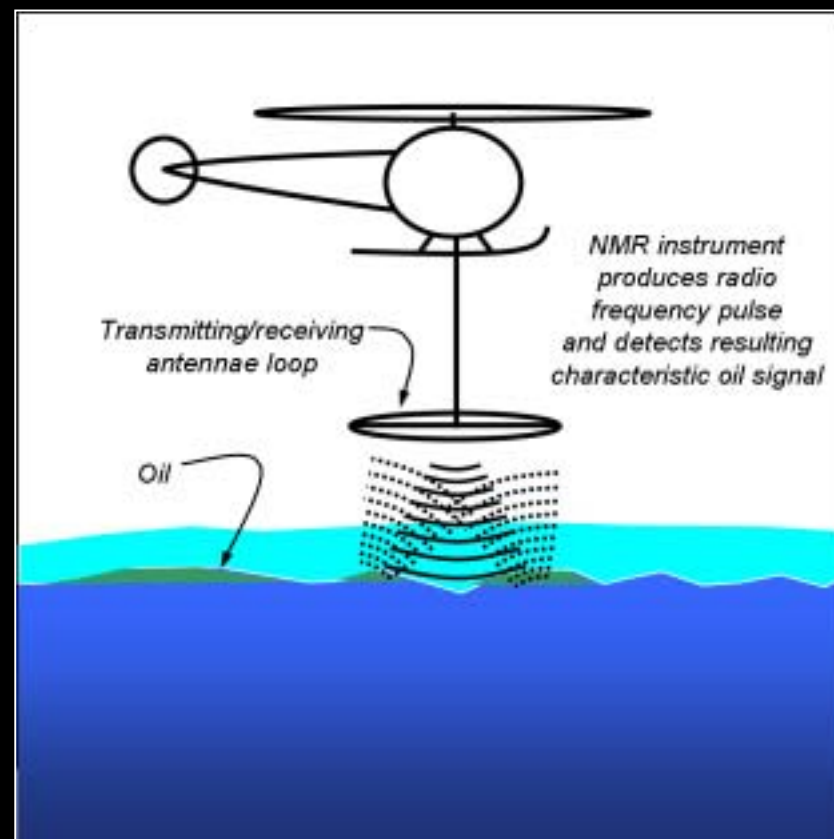


Lab-scale tests

Remote Sensing of Oil Under Ice

- Enhancing remote detection of oil under ice is an important need
- NMR is the only technique to characterize water aquifers remotely
- Relatively simple instrument that utilizes Earth's magnetic field
- Ice is virtually invisible to the instrument

*Utilize nuclear magnetic resonance
in the Earth's magnetic field*



Summary

Our findings indicate

- *Dispersants work in ice given enough mixing energy*
- *EM's new dispersant gel allows more efficient use of dispersants—may triple capacity and allow treatment of cold/viscous oil*
- *ASD Ice breakers and EM's diversion-boom concept effectively supply mixing energy if needed*
- *Standard tests may bias dispersant effectiveness tests particularly for challenging conditions*
- *In-situ burning is effective if ice containment is sufficient*
- *Chemical herders extend in-situ burning to lower ice conditions*
- *New remote detection concept using NMR may close important gap*

The End